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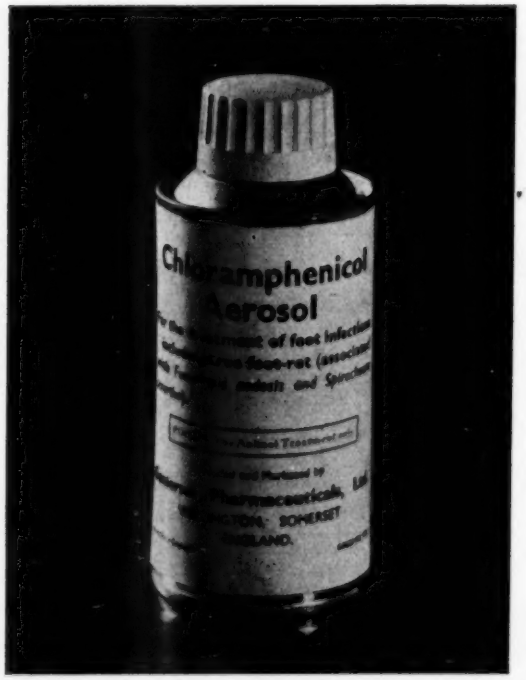

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An Assessment of the Intravenous Tuberculin Test as an Aid in the Diagnosis of Tuberculosis in the Dog

BY

E. THORPE

University of Glasgow Veterinary School

TUBERCULOSIS in the dog is not readily diagnosed from clinical signs alone. An infected dog is a potential danger to human beings and, if only for this reason, a quick and reliable method for the early detection of such animals would be of great value.

Tuberculosis may be diagnosed by bacteriological culture of the organism, by animal inoculation, by biopsy and histological examination or by the making of smears of exudate or body fluids. The first two methods involve a long time lag in obtaining confirmation or otherwise ; the third method is very restricted in application. The finding of acid-fast bacteria in sputum or in the centrifuged deposit from pleural or peritoneal fluids gives a positive diagnosis, but failure to find such bacteria does not by any means exclude the disease.

Intradermal and subcutaneous tuberculin tests as employed in cattle have been used in the dog but are considered to be unreliable as they often fail to detect infected animals (Boddie, 1952 ; Davies, 1947 ; Hagan & Bruner, 1951 ; Hutyra, Marek & Manninger, 1949).

Smythe (1929) employed ophthalmic, intradermal and subcutaneous tuberculin tests in the dog, and obtained temperature reactions in positive cases using the subcutaneous route.

Laborie (1951) reported the use of an intravenous tuberculin test in the dog, using a dose of 0·1 ml. of a 1 in 10,000 solution of tuberculin. A rise in temperature half an hour after the injection, with the maximum temperature reaction up to two hours post injection, was noted in positive cases. A stronger thermal reaction was obtained with an increase in dosage.

An intravenous tuberculin test was employed as part of the examination for tuberculosis in dogs admitted to this hospital. The findings in 50 dogs submitted to this examination with reference to the diagnostic value of the tuberculin test are described.

Animals Tested

The 50 dogs submitted to the test fell into three groups :—

Group 1 comprised eight dogs which were known to have had contact with human beings affected with tuberculosis.

Group 2 comprised 21 dogs admitted to this hospital for diagnosis where tuberculosis was a possible (although not always a probable) cause of the clinical signs shown. Animals in this group included dogs showing symptoms of chronic respiratory disease, chronic diarrhoea or loss of weight.

Group 3 comprised 21 apparently normal dogs which were subjected to a thorough clinical examination before being lodged in the hospital.

All dogs in Group 1 were subjected to a thorough clinical examination, special attention being paid to the thorax, abdomen and superficial lymph nodes. This was followed by radiographic examination. Pharyngeal and rectal swabs and a urine sample were taken for cultural examination, and the tuberculin test was then applied.

Each dog in Group 2 was examined clinically. Radiographic examination was made in the majority, and material for culture was taken from some.

The tuberculin test was done on the dogs in Group 3 as part of a routine procedure applied to dogs likely to remain in the hospital for some time.

The result of *post-mortem* examination was available in a number of cases from the second and third groups.

Dogs were considered not to be affected with tuberculosis when radiographic, cultural, *post-mortem* and histological findings showed no evidence of tuberculosis.

Technique

In this investigation mammalian tuberculin P.P.D. supplied by the Ministry of Agriculture and Fisheries, Weybridge, was used in a dosage of 0·1 ml. (0·2 mg.

SUMMARY OF CLINICAL FINDINGS AND RESULTS OF THE TUBERCULIN TESTS

Rise in temperature	Clinical Total No.	Clinical Findings		X-Ray			Culture			*Post Mortem*			Final Diagnosis	
		Pos.	Neg.	Pos.	Neg.	N.A.	Pos.	Neg.	N.A.	Pos.	Neg.	N.A.	Pos.	Neg.
GROUP 1														
Not exceeding 0·5° F. ...	1	0	1	0	1		0	1	0	0	0	1	0	1
Not exceeding 1·0° F. ...	5	0	5	0	5		0	5	0	0	0	5	0	5
Not exceeding 2·0° F. ...	0	0	0	0	0		0	0	0	0	0	0	0	0
Exceeding 2·0° F.	2	0	2	1	1		0	2	0	0	0	2	0	2
GROUP 2														
Not exceeding 0·5° F. ...	7	3	4	3	3	1	1	4	2	1	2	4	1	6
Not exceeding 1·0° F. ...	5	3	2	2	3		1	2	2	1	2	2	1	4
Not exceeding 2·0° F. ...	5	3	2	3	1	1	2	1	2	2	1	2	2	3
Exceeding 2·0° F. ...	4	3	1	2	2		2	2	0	2	0	2	2	2
GROUP 3														
Not exceeding 0·5°F. ...	9	0	9	0	0	9	0	0	9	0	2	7	0	9
Not exceeding 1·0° F. ...	3	0	3	0	0	3	0	0	3	0	1	2	0	3
Not exceeding 2·0°F. ...	6	0	6	0	0	6	0	0	6	0	1	5	0	6
Exceeding 2·0° F.	3	0	3	0	0	3	0	1	2	0	3	0	0	3

POSITIVE—Indication of some clinical abnormality.
N.A.—Not ascertained.

of tuberculin). The tuberculin was diluted with 1 in 100 with sterile normal saline, thus making 10 ml. of solution for injection.

The rectal temperature of the dog at rest was taken before injecting the tuberculin solution slowly into a cephalic vein. Temperature recordings were made at 30-minute intervals for five hours after the injection.

Results

A summary of the result is given in the table above.

Nature of Temperature Curves. In the majority of cases the maximum temperature rise occurred one or two hours after the injection of tuberculin. In only one case (tuberculous dog No. 5403) was the temporary rise delayed to the fourth hour after injection.

In almost every case the temperature of a marked reactor returned to normal within five hours, while dogs with milder reactions regained pre-injection temperature in a much shorter time. Slight fall in temperature of less than 0·5° F. in the first half hour was noted in a number of non-tuberculous dogs. No constant differences in the pattern of temperature curves could be observed between tuberculous and non-tuberculous dogs, nor between dogs in the three groups.

Analysis of Findings. In Group 1 a maximum rise of up to 3·4° F. occurred in two out of eight dogs, but was not associated with tuberculosis on clinical, radiological or bacteriological grounds.

In Group 2, six out of 21 dogs were shown to have tuberculosis. Of these, only two animals had marked temperature rises (3·3° and 3·4° F. respectively). One had a rise of less than 0·5° F. and the remaining three dogs showed small rises.

Of the other 15 animals in Group 2, two had rises of over 2° F. (2·6° and 3·6° F. respectively), six had a rise of 0·5° F. or less, and the remaining seven showed small rises.

In Group 3, three of the 21 apparently normal dogs showed rises of over 2° F. (2·4°, 2·8° and 3·0° F. respectively), nine showed a rise not exceeding 0·5° F., and the remaining nine had small rises. None proved to be tuberculous.

Summary of Findings. Of the 50 dogs examined, six animals were affected with tuberculosis. Two of these dogs had marked temperature rises, one had a rise of less than 0·5° F., and the remaining three dogs showed small rises. Among the 44 non-tuberculous dogs, seven showed marked temperature rises, 16 showed rises of less than 0·5° F., and the remaining 21 showed small rises.

Discussion

The results of these trials show that the intravenous tuberculin test under investigation was unreliable as a specific diagnostic agent for active tuberculosis. This is evidenced by the fact that seven out of 44 non-tuberculous dogs developed a strong thermal reaction to the test, while 21 others showed a mild reaction. On the other hand, only two out of six tuberculous animals reacted strongly to the test, while the remaining four tuberculous dogs had temperature rises of less than 2° F. However, three of these dogs were fevered before the test was started, a fact that may have influenced the results. Another point is that all the tuberculous dogs had active progressive lesions. In cattle, it is known that when tuberculosis has reached an advanced stage the tuberculin test may give negative result. A similar explanation could perhaps account for the failure of four tuberculous dogs in this investigation to respond to the test.

It may be argued that the non-tuberculous dogs which reacted had recovered from their infection, although remaining in a state of allergy. This contention cannot be disputed as a healed primary focus is notoriously difficult to find in the dog even when active secondary lesions are present. The purpose of the present work, however, was to estimate the use of such a test in clinical work, and as such it is not of value.

Summary

Fifty dogs in three categories were submitted to an intravenous tuberculin test. Six of these later proved to be affected with tuberculosis.

(*Continued at the foot of col.* 1, *page* 557)

An Account of the Gain and Loss of the Infective Larvae of Parasitic Nematodes in Pastures *

BY

E. L. TAYLOR

Ministry of Agriculture, Fisheries and Food, Weybridge, Surrey.

Host-parasite Relationship—Period of Evolution

WHOEVER reflects for a little time on the adaptation of parasites to their hosts must realise the very great importance of the proper regulation of their numbers. With very few exceptions parasitic disease is only brought about when the numbers of parasites become excessive, and as disease of the hosts represents a serious threat to the whole community of parasites it is obvious that it has been of the greatest importance to the parasite to develop means whereby numbers might be regulated. This is the borderline of health and disease along which the host and parasite community has evolved. Those communities that have been unable to adapt have been eliminated and, as a corollary to that statement, those that exist to-day must have adapted, so that a normal host-parasite relationship must of necessity be a healthy one.

Our ideas on immunity have changed a great deal since the early concept of Pasteur and his associates. As with so many scientific ideas, we begin by seeing clear distinctions, a thing is either black or it is white, and it is only subsequently that we begin to realise that those two extremes are joined by inseparable shades of grey. In the first concept of immunity an animal was thought to be either immune or susceptible. At the present time, however, we recognise that there is a gradation between the two, and that the kinds of response are almost as varied as the degree. The new term "host-parasite relationship" which has a much wider reference is therefore more fitting and more generally useful.

One necessary step in our understanding is to recognise the benefit of the immunity relationship to the parasite as well as to the host. The simple view of the function of the immune response is that it is merely a means by which the host is protected from the depredations of the parasite: but in actuality it is much more than that, it is a means of regulating parasite population, so assuring a balanced relationship in which both host and parasite can thrive.

On account of their development through action and reaction over enormous stretches of time we may safely assume that these relationships are in reality more complicated than they seem to be. One or two examples will suffice to show this. The members of the genus *Trichonema*, one of the smaller red worms of the horse, have reached a point of adaptation in which, as Gibson's work shows (1953), infection can only be acquired in early life, while the foal is still subsisting on its mother's milk. These larvae then enter the mucous membrane of the large intestine where they develop to the early fifth stage, that of the immature adult. Only a proportion of this number, however, immediately re-enter the lumen of the gut where they complete their development, the rest remaining where they are in the wall. We believe that some of them remain there for years, waiting until such time as the existing population of adult *Trichonema* is reduced. This may come about through ageing or from some other cause, so that "room" for additional adults is provided; a number of larvae, approximately equal to the number of adults that have been expelled, then leave the gut wall and take up the final stage of their development.

The point to notice in this example is not merely that the equine host has learned to protect itself, but that the parasite has assured itself of numerical control of its population in the horse's gut and of continued sojourn throughout the life of the horse, without the risk of killing its host.

The next example that I should like to quote concerns our old friend the twisted wireworm of the sheep. At one time we prided ourselves that we really were beginning to know something about this parasite's relation to its host. The young lambs were thought to pick up a few larvae with their first taste

* Paper presented at the Second British Caribbean Veterinary Congress, Kingston, Jamaica, July, 1956.

An Assessment of the Intravenous Tuberculin Test as an Aid in the Diagnosis of Tuberculosis in the Dog.— *Concluded.*

The result of the test was assessed by the extent of the thermal reaction.

A strong thermal reaction, in excess of 2° F., was observed in two tuberculous and seven non-tuberculous dogs.

It was concluded that the tuberculin test used in this investigation was unreliable as a specific diagnostic test for tuberculosis in the dog.

Acknowledgments.—I wish to express my thanks to the Pathology Department of Ruchill Hospital, Glasgow, for carrying out the bacteriological examinations.

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of grass. Within the space of three weeks they began to re-infect the ground and from that point onwards the infestation of the pastures and of the lambs themselves rose at an ever-increasing rate until ultimately a point was reached at which the worm-burden of the lambs was sufficiently great to stimulate a resistance that terminated the infestation and changed the susceptible, immature lamb into a resistant adult.

We now begin to see that the relationship is much more complicated. Under certain conditions (what they are we do not yet properly know) the adult sheep may carry quite a number of these parasites and continue to carry them so long as infective larvae are not acquired in numbers. If a reasonable dose of larvae is picked up, however, the existing infestation of adults is eliminated and some of the newly acquired larvae grow up to take their place.

We may conclude, as a partial explanation, that the immune bodies which act on the adults take no effect upon the larvae, but we are still left wondering what the need could be for this changeover of population, and a feeling that this strange relationship represents only one of many complications of which we, as yet, know nothing.

As a further addition to the complexity I have permission to refer to a private communication from F. H. S. Roberts of Yeerongpilly who has been repeating some of this work but has been using the *Haemonchus* that occurs in cattle and that by the workers of Yeerongpilly is now regarded as a separate species, named *H. placei*. The relation between these two species appears to be different again in that so long as the host is carrying an infestation of the adult worms it is protected against a superimposed infestation of adults. The larvae which are picked-up from the pasture, however, are only inhibited in their development and can remain alive in the stomach in that undeveloped state for a period of several months during which time they may be regarded as " waiting for room " in the stomach—in the way that Gibson's *Trichonema* wait in the mucous membrane for room in the lumen of the large bowel of the horse. Dr. Roberts finds that the only way by which he can consistently produce a heavy experimental infestation in a bovine is by giving several successive doses of larvae followed by a treatment with phenothiazine, against which young adults and probably late fourth-stage larvae are highly resistant. In the absence of the biochemical substances that are associated with the adults, and that (presumably) have so far been holding the developing larvae in check, these immature forms now develop and a pathogenic infestation of adult worms may result through many immature forms growing up together.

These are only examples from two nematode genera. We know certain details of a few others; the phenomenon of premunition as a protection against over-population is known to apply to certain tapeworms, both in the adult and in the cystic stage, and that is the extent of our knowledge; the variety in these relationships must, however, be very great indeed, and the work of unravelling the complexities of host-parasite relationships will be an endless task for the parasitologists of the future.

We see, therefore, that the elimination of the unfit variants in parasite or in host species and the selection of those species that adapt to the environment leads to some extraordinary complications. It is a process that has operated throughout evolutionary time along the borders of health and disease, and its main concern has been the control of parasite populations. Where successful means of controlling populations have failed, disease has been inevitable and the species has ceased to exist. In our agricultural endeavours we employ a substitute for natural selection; the methods of progress, however, have to operate in the same world of hosts and parasites, and we find that we have taken over the management with very inadequate knowledge of the interplay of the complicated forces that had evolved for the maintenance of parasite populations. The methods that we employ in our substitute for natural selection are something as follows:—

Host-parasite Relationship—Period of Progress

For the main part it is through trial and error investigation that we find some way of producing heavier crops or larger and more productive animals, such as provide an obvious advantage in our aim for increased output from the land. After the first recognition of their success, these new methods are publicised and begin to be put into extensive use, the claims of the discoverers are confirmed, and it is made clear to everyone that more grass can indeed be grown by these means, more sheep kept, and more mutton produced. After the new practices have been in use for some little time, however—perhaps for three or four seasons—it becomes clear that all is not well; something has gone wrong; losses from parasitic disease are much greater than they were under the old system, and a trend sets in for farmers to relinquish the new practices and go back to the system used by their fathers; a system that could at least be relied on to yield a certain return. Better be sure of something small than to run the risk of losing everything.

It now becomes necessary for those who introduced the new system to find out the reasons for its failure. As a rule, this falls to the lot of a very small group of specialists who must endeavour to put things right. Their energies may be expended in a search for new anthelmintics in order to destroy the parasites, but the logical approach is to find out more about the mechanism of the natural regulation of parasitic populations.

Again, at this step, we are dealing with the borderline of health and parasitic disease. The precise nature of the derangement, however, is not easy to recognise; I have endeavoured to show something of the complexity of the direct host-parasite relationship, depending upon the interaction of a large number of different factors. There is, however, one other group, concerning the acquisition of infective larvae from the pastures, that would appear to be more amenable to investigation, and it seems worth while giving a brief account of some data that were collected

in an attempt to find a better understanding of the relative importance of the various factors that are concerned in the increase and decrease of larval infestation of pasture herbage. For this purpose resort was made to the use of a numerical representation of the extent of infestation, based on data that had been collected during the course of investigational and experimental work at Weybridge, or that had been published by workers elsewhere. This method does not pretend in any way to be mathematical but is used only as a way of dealing separately with the several influences, so that their relative importance may be recognised. Most of the figures that are used concern the trichostrongylid parasites of sheep, but there is little doubt that the general conclusions apply to other stronglyoid nematodes as well and to species of grazing animal other than sheep.

1. *Number of Larvae per Unit Weight of Herbage*

The figures that are presented in Table I show the estimated numbers of larvae per pound of herbage based on a sample of several ounces collected from 800 places in the pasture, as described by Taylor (1939). These examples represent a selection from a large number of examinations that have been carried out during the past several years and give an indication of the great variability in the rate of intake, and the enormous number of larvae that are acquired during the course of grazing on infected pastures.

As there cannot be anything exact about the figures and we are only concerned with trends there is no need to enter into discussion over the various results that have been obtained by different workers, on the amount of green-food eaten by a sheep during the course of a day. It seems reasonable, therefore, to accept an approximation, that the daily intake of dry matter is somewhere between 2.5 and 3 per cent. of their live-weight. Supposing one takes the mean of 2.75 per cent. and that the water content of herbage is 80 per cent.—which is another reasonable approximation—then a ewe of 100 lb. will ingest some 14 lb. of grass daily and a five-month-old lamb of 50 lb. ingest 7 lb. daily; the daily intake of larvae is then as shown in the last two columns of Table I.

Apart from the great variation in the concentration of larvae in individual fields as shown by these few examples, and some evidence of a rise in the larval count throughout the spring and summer, there is one other remarkable feature to observe at this point, that the ewes grazing along with their sick and dying lambs in examples 6 and 7 were in thriving condition in spite of ingesting some tens of thousands of larvae daily.

2. *Numbers of Larvae per Unit Area*

Under the hypothetical condition of completely static herbage, the numbers of larvae per unit weight are in no way affected by the grazing of sheep; the herbage remaining in a field being as heavily infected as that which has been eaten off. If, however, figures are available on the numbers of larvae per pound of herbage and on the weight of herbage per acre, and an estimate is made of the numbers of available larvae that a field contains, some idea is obtained of the infection potential of *the area*.

Figures for which I am indebted to Mr. A. E. M. Hood of the Jeallots Hill Research Station show that the amount of herbage in a field in this country may vary from some say 280 lb. where it is very thoroughly grazed, to some 11,200 lb. of long lush herbage. Suppose an example be taken of a field in which there are 400 larvae per pound of herbage, this would then represent a range from 100,000 to 4,480,000 larvae per acre. These figures provide a means of showing the relative dangers of an acre of bare pasture as compared with an acre of well-grown herbage when each are carrying the same number of larvae per pound. The residual infestation in the field is very different, in the one instance there is nothing to trouble about, but in the other sufficient larvae to cause disease.

Table II gives figures from estimations of the herbage content of actual fields in which sheep were grazing, and the numbers of larvae per pound of

TABLE I

SHOWING THE NUMBERS OF INFECTIVE TRICHOSTRONGYLID LARVAE IN VARIOUS EXAMPLES OF PASTURE HERBAGE, AND THE NUMBERS OF LARVAE INGESTED DAILY BY SHEEP GRAZING ON THOSE PASTURES

	Type of Pasture	Stock grazing the pasture	Larvae per lb. herbage	Daily intake of larvae by sheep	
				Adults	Lambs
1.	Laboratory paddock, permanent pasture closely grazed, June	Adult sheep	493	6,902	3,451
2.	Laboratory paddock, permanent pasture closely grazed, December	Adult sheep	42	588	294
3.	Laboratory field, closely grazed, permanent pasture, November	Variable number of sheep and cattle	87	1,218	609
4.	30-acre permanent pasture, October—ample herbage	Lambs	183	2,562	1,281
5.	Lush, ley pasture, rotational grazing, January	Lambs	212	2,968	1,484
6.	Lush, ley pasture, rotational grazing, June	Ewes and lambs	5,148*	72,070	36,035
7.	Lush ley pasture, rotational grazing, July	Ewes and lambs	2,575*	36,030	18,025
8.	7-acre ley pasture closely grazed	Lambs	2,033*	28,462	14,231
9.	71-acre field on Romney Marsh, August	Lambs	602	8,428	4,214
10.	11-acre field on Romney Marsh, August	Lambs	493	6,902	3,451
11.	Cheviot Hills. Bracken and grass extensive grazing, June	Ewes and lambs	63	882	441
12.	Cheviot Hills, patch of good grass, June	Ewes and lambs	174	2,436	1,218

* Acute parasitic gastritis developed at the sites where these samples were collected.

TABLE II

SHOWING THE ESTIMATED NUMBER OF POUNDS OF HERBAGE PER ACRE, AND NUMBERS OF TRICHOSTRONGYLID LARVAE BOTH PER POUND AND PER ACRE

Nature of pasture	Pounds of herbage per acre	Larvae per lb.	Larvae per acre
Bare permanent grass, laboratory paddock, April ...	1,488	740	1,101,000
Permanent grass, laboratory paddock, July	2,209	1,359	2,670,000
12 acre field, permanent grass grazed by ewes and lambs, August	8,087	174	1,407,000
Above field in September ...	5,568	328	1,826,000
Same field in January ...	1,538	16	24,000
August. 23 acre field of permanent grass with much clover 4 in. high.* ...	7,036	1,055	7,423,000
14 acre field 3-year ley, August.*	2,662	677	1,802,000
6 acres of permanent pasture, September	3,323	401	1,332,000
8 acres, temporary pasture in October	3,630	212	769,000

* Acute parasitic gastritis was present among the lambs in these two instances.

herbage in those fields. The estimation of the quantity of herbage was obtained by dividing the field into five representative areas, throwing a quadrat three times at random in each area (the quadrat being of such a size as to enclose two square feet of herbage) and collecting the herbage for weighing, by clipping closely with shears.

3. *Effect of Rate of Growth of Herbage*

Consideration may now be given to the factor of dilution caused by the growth of herbage. If we start with the lowest figure associated above with bare pasture, *i.e.* 100,000 larvae per acre, where there are only 280 lb. per acre of herbage carrying 400 larvae per pound, then the numbers of larvae per unit weight of 1 lb. of herbage would be reduced by the growth of the grass.

A. E. M. Hood's figures show that the weight of grass per acre, during the peak growing period, may rise from next to nothing up to 15 cwt. of dry matter per acre within 30 days, or, if we convert to wet herbage suppose we say 280 lb. up to 8,400 lb., as a result of which growth the numbers of larvae per unit weight would be reduced in that same proportion.

The dilution factor is thus seen to be a potent one and it may reasonably be supposed that during periods of rapid growth the rate of intake of larvae by grazing animals is sometimes halved within a period of only two or three days, and reduced to one-tenth, or even less than that, within a fortnight. This, without doubt, constitutes one of the principal reasons for the time-honoured custom of the intermittent resting of pastures.

4. *Success of Larval Development in the Faeces*

This factor is perhaps the most variable and the least accountable of all. It is governed by temperature and moisture; these conditions, however, are not entirely governed by meteorological changes, but also by variations in the soil and in the herbage, affecting the microclimate between the herbage plants. Length and density of the herbage is undoubtedly of first importance and may be such as to result in a maintenance of 100 per cent. relative humidity in the region of the infected faeces. The difference between these favourable conditions for larval development and the unfavourable ones such as exist on sparse and bare pasture is often so great as to be the decisive factor in the health of the grazing stock. The divergence of effect is seen to the greatest advantage in hot climates where helminthiasis rarely appears during a dry season.

Although there are numerous records of observations on the effect of relative humidity and temperature under laboratory conditions, however, there are very few records of observations on larvae in the natural surroundings out of doors. Shorb (1943) observed the development of infective larvae from the eggs of *Haemonchus contortus* in sheep's faeces placed on bare plots, and on grass-covered plots, during the month of August at Washington, D.C. He recovered one larva for every 506 eggs placed in the grass, but only one larva for approximately every 660,000 eggs in faeces placed on bare ground.

The following table shows some results that have been obtained under experimental conditions at Weybridge where a comparison was made between the numbers of larvae recovered from grass that had been cut from small, nine-inch square experimental plots grown in boxes out of doors. Four of the plots had been cut short with a pair of scissors and the other four allowed to remain long. At that time, 100 g. of sheep's faeces in pellet form were placed on each plot, representing 1,215,000 eggs of *Haemonchus contortus* per plot. A laboratory culture made from a ninth sample of 100 g. of these same faeces yielded 420,000 infective larvae.

After allowing an interval of three weeks for larval development, successive plots were cut at weekly intervals; the larvae were then recovered by washing the grass in water and were enumerated under the microscope. The results are shown in the following table.

One series of observations by Michel & Rose (1954) where a faecal sample infected with *Dictyocaulus*

TABLE III

SHOWING THE NUMBERS OF THIRD STAGE LARVAE RECOVERED FROM SHORT GRASS AND FROM LONG GRASS, 4, 5, 6 AND 7 WEEKS AFTER THE DEPOSITION ON TO EACH PLOT OF 100 GRAMMES OF SHEEP'S FAECES CONTAINING 1,215,000 EGGS OF *H. contortus* PER GRAMME.

Date at which grass was cut	Number of third stage larvae recovered		
	Short grass	Long grass	Proportionate number
18.10.1954	19	12	$\frac{1}{2}$
25.10.1954	316	1,976	× 6
1.11.1954	465	3,300	× 8
8.11.1954	19	8,487	× 400

filaria was spread over the herbage, also showed a greater development in the long herbage, there being 31 times as many larvae in the long as in the short herbage.

5. *Effect of the Resistance of the Stock on Larval Content of Herbage*

The influence of the resistance of adult stock not only concerns the stock themselves, but also has a marked effect on the larval content ot the herbage. There is a very considerable difference between the numbers of eggs per g. in the faeces of susceptible young animals and of resistant adults, which variation signifies a great difference between the numbers of larvae added daily to the pasture by animals of these two ages or states of resistance. The total output of faeces per day may be sufficiently closely estimated from figures that appear in the literature. The 26 ewes that were employed by Woodman *et al.* (1937) in determining the amount of grass consumed by sheep bred by crossing a Suffolk ram with Cheviot × Border Leicester ewes, passed on an average approximately 6 lb. of faeces during a day. Spedding (1952) gives particulars of some observations on shearling sheep of the same breed from which the average output of faeces is calculated to have been 4.9 lb. per day. These sheep would probably exceed the weight of 100 lb. as taken for our standard sheep and for the present purposes it will be an adequate approximation to consider the 100-lb. sheep to be passing 4.8 lb. and the lamb 3 lb. of faeces during the day.

The egg counts that appear in the following table are taken from data collected during the examination of material sent into the Weybridge laboratory from groups of sheep that may or may not have been concerned in naturally occurring outbreaks of parasitic gastro-enteritis.

TABLE IV

SHOWING THE NUMBERS OF EGGS ADDED TO THE PASTURE DAILY BY VARIOUS SHEEP UNDER A VARIETY OF CONDITIONS

Description of grazing animal and of conditions of grazing	Nematode eggs per gramme of faeces	Eggs added to the pasture daily by each sheep
Average of 14 ewes on rotational grazing in September ...	60	130,752
Average of 14 lambs running with the above ewes, some severely affected with parasitic gastritis	1,690	3,069,040
Average of 6 ewes on paddock at laboratory in September ...	120	261,504
Average of 12 lambs brought from hill pasture and running on aftermath	1,140	2,070,244
Average of 20 ewes in a large flock of downland sheep on ley pasture	300	653,760
Average of lambs that were running with the above ewes, many suffering from parasitic gastritis	4,500	8,172,000
Average of 45 Romney Marsh lambs in November ...	2,300	4,176,000
Average of 12 ewes on the general laboratory pasture in May	400	871,000

A glance at the figures in this table gives a good impression of the difference between the rate of the addition of larvae to the pasture when grazed by susceptible young animals on the one hand and by resistant adults on the other. It is seen that the summation of infection may proceed some 10 times as quickly where young stock are grazing.

An average of the figures shown in Table III on the numbers of eggs required for each larva that reaches the infective stage over a period of seven weeks suggests that some 600 eggs may be required to produce one infective larva. These figures were obtained by observations made during a very wet October, so that a general average for the whole country might be less, and for the sake of reasonable argument one might regard 1,000 eggs per larva as the usual proportion. If then this proportion be applied to figures given in Table IV on the numbers of eggs per g. in the faeces of ewes and of lambs, it is seen that on an average, ewes passing 4.8 lb. of faeces containing 200 eggs per g., only one in a thousand of which produces an infective larva, will be adding only 436 larvae per day. In one of the examples given in Table I, however, ewes which remained healthy and thriving were grazing herbage that carried some 5,000 larvae per pound. At the rate of consumption of 14 lb. of herbage per day, those ewes, while producing only 436 larvae would be lessening the infestation of the plot by some 24,000 each day. Furthermore, this beneficial action does not apply only where ewes are grazing alone, it operates with equal effect where they are grazing along with the lambs.

In order to exemplify this it might be advantageous to consider some hypothetical figures, all of which, however, are well within the range of normal occurrence. A lamb grazing on herbage carrying 150 larvae per pound and eating 7 lb. in 24 hours will remove 1,050 larvae. If, however, the 3 lb. of faeces that it passes during that period contain 1,500 eggs per g., and one egg out of every 1,000 reaches the third larval stage, it will be adding 2,049 larvae daily, representing an over-all increase of 999 larvae per day. Suppose a ewe passing 200 eggs per g. of faeces then be placed along with the lamb to graze the same area of pasture, then at the same rate of development, but passing 4.8 lb. of faeces (as has been taken for the standard), it will be adding 436 larvae daily. The average ewe that has been taken as the example, however, eats some 14 lb. in a day, which at the rate of 150 larvae per pound represents the removal of 2,100, or an over-all reduction of the infestation of the field by 1,664 larvae per day (2,100 minus 436). Where such a ewe and its lamb are grazing together over the same ground, the net result is to add 2,485 larvae per day, but to remove 3,150, representing an over-all decrease of 665, which is a very considerable aid to the cleaning up of the pasture. This effect is summarised in Table V overleaf.

This happy state, however, does not always exist where ewes and lambs are grazing together. Reference has already been made to the great variability

TABLE V

SHOWING THE BENEFICIAL EFFECT OF GRAZING RESISTANT ADULT SHEEP ALONG WITH SUSCEPTIBLE LAMBS IN REDUCING THE LARVAL CONTENT OF THE HERBAGE

		Lamb	Ewe
Daily egg output where the lamb passes 3 lb. of faeces containing 1,500 e.p.g., and the ewe passes 4·8 lb. of faeces containing 200 e.p.g.		2,049,000	436,000
Resulting larvae where 1 egg out of each 1,000 reaches the infective stage		2,049	436
Daily intake of larvae where there are 150 per lb. of herbage, and where the ewe eats 14 lb. and the lamb eats 7 lb. in a day ...		1,050	2,100
Resulting daily increase or *decrease* of larvae in the herbage ...		999 increase	1,664 decrease
Overall result where ewe and lamb are grazing together on the same area	Larvae added	2,485	
	Larvae picked up	3,150	
	Decrease of larvae in the herbage	665	

TABLE VI

FOR COMPARISON WITH TABLE V, TO SHOW THE COMPARATIVELY SLIGHT BENEFIT OF GRAZING BY ADULT SHEEP WHERE LARVAL DEVELOPMENT IS EXCESSIVE, AS IN RANK HERBAGE DURING MOIST AND WARM WEATHER

		Lamb	Ewe
Daily egg output where the lamb passes 3 lb. of faeces daily, containing 1,500 e.p.g. and the ewe passes 4·8 lb. of faeces, containing 200 e.p.g.		2,049,000	436,000
Resulting larvae where 1 egg out of each 100 reaches the infective stage		20,490	4,360
Daily intake of larvae where there are 150 per lb. of herbage, and where the ewe eats 14 lb. and the lamb eats 7 lb. in a day ...		1,050	2,100
Resulting daily *increase* of larvae in the herbage		19,440	2,260
Overall result where ewe and lamb are grazing together on the same area	Larvae added	24,850	
	Larvae picked up	3,150	
	Increase of larvae in the herbage	21,700	

in the success of larval development in the herbage, dependent upon weather conditions and on the microclimate of dense or of sparse herbage.

The following table, differing from the preceding one, in so far as theoretical conditions are concerned, only in the matter of the success of larval development, shows the relatively ineffective operation of the ewes. This lack of effect would be most marked at the beginning of a period of successful larval development while they were still picking up only 150 per day. As soon as weather conditions less favourable to larval development returned the beneficial effect of their presence would again be felt. The table shows, however, that, under our standard conditions, if the percentage larval development increases tenfold, as it well might do with a change of weather, the decrease of 1,250 larvae per ewe-day might change to an increase of 1,000, and the total per lamb + ewe-day change from a decrease of 750 to an increase of 19,500. This is shown in Table VI.

Discussion

One or two practical points remain to be discussed. The preceding account has dealt almost entirely with static conditions, in order to facilitate the separation of the various influences. The actual circumstances, however, are very different in that four of the main factors which have been considered are in a state of continual change: (a) the growth of herbage tending to dilute the numbers of larvae and to provide increasing shade for the development of more larvae, (b) the larvae being continually eaten off by the grazing animals, along with the herbage, (c) eggs of parasitic worms being continually deposited on the ground, adding to the numbers of larvae, and (d) infective larvae already present in the grass dying off. All of these changes are operating on a background of changing weather and varying susceptibility and resistance of grazing animals.

The numerical presentation employed in this paper does not pretend to be mathematical, and by way of apology to those who have developed an appreciation of the value of the statistical approach, and ask for precision in the handling of figures, I should like to quote a brief passage that I found in the introduction to David Lack's new book on "The Natural Regulation of Animal Numbers." After saying that the complexity of nature has led some ecologists to despair of the population problem ever being solved he refers to the statistical approach and then goes on to say:—

"The naturalist feels intuitively that there may be a catch somewhere, but is not qualified to discuss equations. Moreover, 'if you get on the wrong track with the Mathematics for your guide, the only result is that you get to the Valley of Mare's Nests much quicker; get there so smoothly and easily that you do not realise where you are and it may be hard to unbeguile you. Logic and Mathematics are only of service, then, once you have found the right track; and to find the right track you must exercise faculties quite other than the logical—Observation, and Fancy, and Imagination: accurate observation, riotous fancy, and detailed and precise imagination.' This statement was not, as the reader might think, written by a naturalist but by a leading statistician, the late G. Udny Yule (1920)."

In spite of these very great imperfections the present numerical study gives a clear indication of the trends in parasite population where animals are grazing on restricted areas, and of the probabilities that disease will result. Among these the following may be singled out as of greatest value: (1) that the resistance of adult sheep is such as to allow them to

pick up as many as 72,000 larvae per day and remain healthy; (2) that young stock are of much greater importance in building up the infestations of the pastures than are adults; (3) that a rapid rate of herbage growth is very effective in decreasing the rate of intake of larvae, and (4) that grazing by adult stock is very effective in cleaning a heavily infected pasture, even if these adults are placed on the pasture as an addition to the young stock already present.

The nature and origin of our troubles with parasitic disease have been considerably clarified during recent years. At each new step of our success in increasing the fertility and productivity of the land we see evidence of helminthiasis in the grazing animals, and have come to recognise increased trouble with these parasites as an inescapable accompaniment to the march of progress in animal husbandry.

The natural balance which our agriculture has upset came about through a process of selection along a borderline between health and disease, where, as far as the parasite species are concerned, adaptations have been largely a matter of the adjustment of populations, maladjusted variants that tended to become too numerous being eliminated through the disease which they caused.

In the present period of *progress* (as compared with the period of evolution) we still follow the borderline of health and disease, and trial and error is our guide, the difference from the natural processes being that we watch for the error and endeavour to make adjustments in the environment before disease eliminates the whole community.

The logical approach to the control of parasitic disease at the present time is through the adaptation of animal-husbandry practices to the regulation of parasite populations, so that the development of the resistance of individual hosts may keep up with the acquisition of infective larvae from the pastures. In general this adaptation will, doubtless, have to follow a course of ever-increasing artificiality—as we have already seen in the extreme example of poultry farming, where control has been achieved through the more or less complete removal of the birds from their natural environment. Pig husbandry shows a marked development in the same direction and we can see the same tendency in the husbandry of dairy cattle and of lowland sheep. Our need for the most advantageous continuation in this line of progress is a better understanding of the factors that govern parasite populations, in order that we may re-adjust the host-parasite relationship more quickly whenever it becomes clear that an upset has occurred through some new development. In this way we may hope to continue with our progressive agriculture until such time as advances in chemotherapy enable us to eradicate the parasites.

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The Successful Removal of a Large Cyst from the Pupillary Margin of the Iris of a Cat

BY

J. R. HOLT
Chorley

Subject

A black male cat, age unknown, was brought in for examination because of the presence of a large opaque object obstructing the pupil of the right eye with evidence of blindness on that side. The object was whitish in colour and obviously contained fluid. It was quite mobile and rolled from side to side with the movements of the cat's head. It appeared to come through the pupillary opening.

Treatment

The owner agreed to an attempt at removal, it being thought at the time that it was part of a prolapsed lens, and the cat was anaesthetised with pentobarbitone sodium.

The conjunctival sac was flushed out with acriflavine solution and after draping the area with sterile cloths a pair of self-retaining eyelid retractors was inserted.

Using a No. 11 Paragon blade the cornea was incised at its upper margin just below the limbus, the incision being continued on either side with Castroviejo scissors. The loose flap of conjunctiva was then raised and the cyst grasped with a pair of Lang's iris forceps.

At this point it was seen that the cyst was attached to the nasal rim of the pupil and not to the lens.

The cyst was drawn upwards as far as possible and severed at its connexion with the iris using de Weckers scissors.

There was no haemorrhage.

The incision in the cornea was then closed using Kalt's *fils à cornée* on a half-circle 10-mm. Barraquer needle, any protruding iris being gently replaced with an iris repositor.

The anterior chamber was finally flushed with a weak penicillin solution by means of a fine lacrimal cannula inserted through the edge of the incision and the last suture tied.

The incision was finally dressed with an anaesthetic eye ointment (Ward Blenkinsop's Steravite) and atropine.

Recovery was uneventful and after five days the wound was found to be healed and the cat appeared able to see perfectly.

Comment

It is interesting to note that the opposite eye possessed a large coloboma in the iris giving the appearance of a double pupil. No attempt has been made to repair this defect.

The cat was seen several weeks after the operation for other reasons and it was found that the right eye had now become the dominant eye, with perfect vision as far as could be ascertained.

A Preliminary Trial with Three New Drugs as Prophylactics against *Trypanosoma congolense* in Zebu Cattle

BY

J. ROBSON and A. H. MILNE (Deceased)

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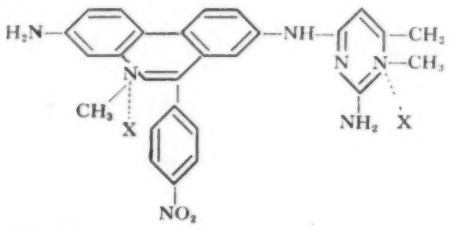
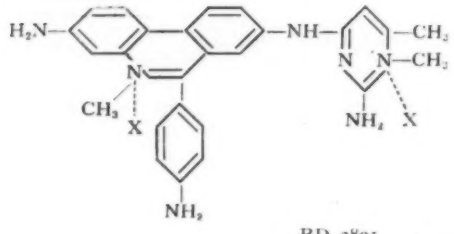
THREE compounds which combine in part the structure of ethidium or dimidium and of antrycide, designated RD 2787, RD 2801, and RD 2902, were kindly supplied by Messrs. Boots Pure Drug Co. Ltd., Nottingham, for the trial. These compounds had been tested by Watkins & Woolfe (1956) who found that their respective prophylactic actions in mice against *T. congolense* were sufficiently promising to justify trials in cattle. The experiment described was therefore planned to determine the prophylactic effect of these new drugs against *T. congolense* in Zebu cattle.

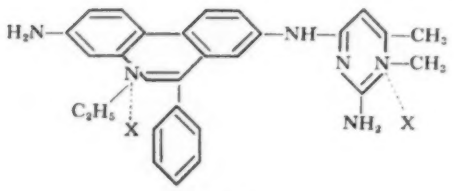
The structural formulae of the three new drugs is as follows:—



RD 2787



RD 2801



RD 2902

(In these formulae X may represent: Cl′, Br′, $SO_3CH'_3$, etc.)

Details of the Experiment

As a preliminary experiment to judge any local and toxic effects of the new compounds, three uninfected oxen each received a subcutaneous inoculation of each compound at a dosage level of 3 mg. per kg. given as a 2 per cent. solution. Severe local reactions occurred in all three oxen and at the end of a week it was found that the cattle had lost 16 lb., 12 lb., and 14 lb., live-weight, but two weeks later all the cattle had regained this lost weight. The swellings noted at the site of inoculation caused no systemic reaction and disappeared within one month, having caused no inconvenience to the cattle.

For the main experiment, 90 Tanganyika Zebu cattle of varying ages, sexes, and sizes, with no previous histories of infection with trypanosomes, were randomised into seven groups as under:—

Group I, consisting of 18 cattle, received the drug RD 2787 at a dosage level of 2 mg. per kg.

Group II, also consisting of 18 cattle, received RD 2801 at 2 mg. per kg.

Group III, 18 cattle, received RD 2902 at 2 mg. per kg.

Group IV, eight cattle, received RD 2787 at a dosage level of 1 mg. per kg.

Group V, eight cattle, received RD 2801 at 1 mg. per kg.

Group VI, eight cattle, received RD 2902 at 1 mg. per kg.

Group VII, 12 cattle were kept as untreated controls.

All drugs were made up as 2 per cent. solutions, all drug inoculations were given intramuscularly, and all trypanosome challenges by subcutaneous inoculation of blood from an ox infected with *Trypanosoma congolense* (strain Godegode II).

The challenging dose, in every case, was a heavy one: 5 to 10 ml. of blood which contained four to five trypanosomes in each field of a thick blood slide when examined under the oil immersion.

The same strain of *Trypanosoma congolense* was used throughout the experiment. The strain, Godegode II, had been proved both invasive and lethal in previous experiments (Milne & Robson, 1955; Milne, Robson & Lwebandiza, 1955).

Throughout the experiment the cattle were kept on tsetse fly and trypanosome-free grazings.

Two months after the cattle had received their inoculation of drug, six cattle from each of Groups I, II, and III, together with two cattle from each of Groups IV, V, and VI, and three from Group VII were challenged with infected blood.

Similarly, four months after the inoculation with the various drugs six animals from each of Groups I, II, and III, two from each of Groups IV, V, and VI together with three from Group VII were challenged with trypanosomes using approximately the same challenging dose.

Six months after the drug inoculations, the remaining six animals in each of Groups I, II, and III,

TABLE I

SHOWING THE PROPORTION OF CATTLE PROTECTED BY THE DRUGS WHEN CHALLENGED TWO AND FOUR MONTHS AFTER DOSING AND GIVING BREAKDOWN IN DAYS AFTER CHALLENGE

Compound inoculated	Dose mg. per kg.	Proportion protected after two months	Breakdown in days after challenge	Proportion protected after four months	Breakdown in days after challenge
RD 2787	2	6/6	Nil	6/6	Nil
	1	2/2	,,	2/2	,,
RD 2801	2	6/6	Nil	6/6	Nil
	1	2/2	,,	2/2	,,
RD 2902	2	6/6	Nil	6/6	Nil
	1	2/2	,,	1/2	45
Controls	Nil		7, 8, 8		9, 9, 11

four animals in each of Groups IV, V, and VI, and three from Group VII were challenged.

Seven months after dosing with drugs, half of those cattle which were challenged at two months and half of those which were challenged at four months, were rechallenged with approximately the same dose of trypanosomes.

Van den Bergh tests and liver biopsies were carried out at intervals throughout the experiment and thick blood slides were taken and examined daily (except Sundays) for two months after challenge and thereafter at weekly intervals for four months.

Results

The drugs when inoculated intramuscularly caused no lameness and no local reactions were noticed.

All the control animals used showed positive blood slides, 7 to 12 days after inoculation with infected blood.

The results of the drug-treated animals are given in Tables I and II.

Seven months after dosing with the drugs, half the number of cattle which were challenged at two months and half the number of cattle which were challenged at four months, were rechallenged with trypanosome-containing blood and the results are shown in Table III.

All Van de Bergh tests which we carried out gave negative results, and liver biopsies showed no signs of infiltration of fat.

All cattle which showed positive slides were eventually treated with ethidium at a dosage level of 2 mg. per kg. and as the trypanosomes disappeared shortly after treatment it was assumed that no resistance to the drug had developed in the trypanosomes.

Conclusions

As can be seen from the above tables, the drug RD 2801, when used at a dosage level of 2 mg. per kg. appeared to protect Tanganyika Zebu cattle for a period of six months when heavy challenges of *T. congolense* by needle were given at two, four, and six months after inoculation with the drug. At seven months, however, only five out of six cattle were protected. The drug RD 2787 appeared to be rather less effective as only four out of six cattle were protected after six months, and also four out of six

TABLE II

SHOWING THE PROPORTION OF CATTLE PROTECTED WHEN CHALLENGED SIX MONTHS AFTER INOCULATION WITH THE DRUGS AND GIVING BREAKDOWNS IN DAYS AFTER CHALLENGE

Compound inoculated	Dose mg. per kg.	Proportion protected after six months	Breakdown in days after challenge
RD 2787	2	4/6	21, 22
	1	2/4	22, 30
RD 2801	2	6/6	Nil
	1	2/4	15, 50
RD 2902	2	3/6	18, 21, 27
	1	0/4	15, 15, 18, 22
Controls	Nil		12, 12, 12

TABLE III

SHOWING THE PROPORTION OF CATTLE PROTECTED BY THE DRUGS WHEN CHALLENGED AT SEVEN MONTHS AFTER DOSING, AND THE DAY WHEN THEY BROKE DOWN AFTER CHALLENGE

Compound inoculated	Dose mg. per kg.	Proportion protected after seven months	Breakdown in days after challenge
RD 2787	2	4/6	16, 17
	1	0/2	17, 20
RD 2801	2	5/6	17
	1	1/2	15
RD 2902	2	2/6	11, 21, 22, 23
	1	1/2	10
Controls	Nil		7, 7, 8

after seven months, when used at a dosage level of 2 mg. per kg. RD 2902 appeared to be the least effective of the three drugs tried.

The use of any of the drugs at the dosage level of 1 mg. per kg. only appeared to protect the cattle for a period of four months, and in the case of RD 2902 one out of two cattle broke down at this time.

The administration of all the drugs appeared, in the majority of cases where breakdown occurred, to lengthen the incubation period of the trypanosome as judged by the daily examination of thick blood smears. In two cases the appearance of trypanosomes

(*Concluded at foot of col. 1 overleaf*)

An Outbreak of Mastitis in Cattle and Death of Calves due to Infection with an Organism of the Friedlander Group (Klebsiella)

BY

F. WHITE

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THE first report of mastitis in cattle due to an infection with Klebsiella was that of Laigret & Leblois (1950) involving the right hind quarter of a single cow, the outcome being fatal. The first report of this organism in bovine mastitis in Great Britain was that of Buntain & Field (1953). In this instance a self-contained herd was involved, the outbreak commencing in five cows, eventually spreading to 29 out of 37 cows and to calves *via* infected milk, four calves subsequently dying. In 1954, Barnes reported four cases of bovine mastitis due to Klebsiella in Iowa, U.S.A. Sacchi (personal communication to Hinze, 1956) reported six cases of mastitis due to this organism in two herds in Maryland. Hinze (1956) reported that in a large herd of Holsteins, in U.S.A., infection commenced in one animal and subsequently spread to a large percentage of the cows. He stated that " It is still responsible for over 50 per cent. of all mastitis in this herd."

A Preliminary Trial with Three New Drugs as Prophylactics against *Trypanosoma congolense* in Zebu Cattle.—*Concluded.*

in the peripheral blood was delayed for as long a period as 45 and 50 days after challenge, the controls first showing positive slides on the *average* on the 9th day, varying from the 7th to 12th day after inoculation.

It appeared from the results obtained in this experiment that the drug RD 2801 (now designated " Prothidium ") was worthy of further field trials.

Summary

Three new drugs which combine in part the structure of ethidium or dimidium and of antrycide were used at a dosage level of 1 mg. and 2 mg. per kg. to protect Tanganyika Zebu cattle against a heavy needle challenge of *T. congolense* given two months, four months, six months, and seven months after inoculation with the drugs.

From the results obtained, the drug RD 2801 appeared to protect the cattle for a period of six months, RD 2787 and RD 2902 appeared to be somewhat less effective.

In cases where breakdown did occur, the previous administration of these drugs appeared to lengthen the period between challenge and the appearance of trypanosomes in the peripheral circulation.

Acknowledgment.—The Director of Veterinary Services, Tanganyika Territory, is thanked for the facilities provided for this work and for permission to publish these results.

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Clinical History

(a) *Dairy Cattle*

The present investigation resulted from an outbreak in an attested dairy herd, largely Ayrshires and Friesians. The cows of this herd had been permanently housed for the winter in two adjoining byres, milking taking place in a milking parlour adjoining the byres. The first case occurred in an Ayrshire × Shorthorn heifer (9A). She calved her first calf at the end of September, 1956, and joined the milking herd. She was in very good condition at calving but consistently lost flesh and her lactation response was poor. About a fortnight later she was off her food for one day, and by next morning, milk from the near hind quarter had a yellowish-brown tinge. She was milked last, her milk being fed to a group of six calves. A sample was taken from the infected quarter, plated out on blood agar, and the remainder incubated. Both plate and incubated milk revealed a pure culture of a gram-negative capsulated rod. The incubated milk had a yellowish supernatant with a greyish-white sticky clot. Klebsiella mastitis was tentatively diagnosed and the animal was isolated immediately in a loose-box in buildings about a mile away from the byres. She was tended by arable land staff, to avoid contact with staff dealing with the dairy herd. A further sample the next day also gave a pure culture of gram-negative capsulated rod, the milk being clotted in the udder and looking exactly like the previous day's sample after overnight incubation. The animal had been in a stall next to a wall; this, together with the three adjoining stalls, was soaked in disinfectant and scrubbed down. On the following day the quarter was enlarged, painful, and inflamed; there was no systemic disturbance.

Twelve days later a six-year-old Friesian cow (5B), who had calved her fourth calf six months previously and had given over 1,000 gallons in her present lactation, showed brownish-yellow milk in one quarter at the morning milking. There was no systemic disturbance and the quarter was only slightly hard. She occupied the fourth stall away from 9A. Culture gave a gram-negative capsulated rod and a gram-positive non-haemolytic micrococcus. She was isolated immediately and all stalls in that row disinfected.

Two months later an Ayrshire cow (344) in the second byre, who had calved 10 months previously, developed a swollen quarter with brownish-yellow milk. The animal was isolated and a pure culture

of a gram-negative capsulated rod was isolated from the milk; there was no systemic disturbance. This animal had cystic ovaries and had failed to hold seven inseminations since calving; she had also been treated twice with luteinising hormone. It was decided to send her for slaughter.

Two and a half months later, a crossbred Hereford cow (46A) calved, and three days later milk from the front right quarter was brownish yellow. She was not in the byre prior to calving. She was isolated and culture gave a gram-negative capsulated rod. There was no systemic disturbance, and no udder changes.

(b) *Calves*

Group I. A group of six calves, all about 14 days old, were fed on milk from heifer 9A on two successive days, including some milk which looked abnormal. They were kept under observation. A fortnight later one was seen with a nasal discharge. Subculture from a nasal swab gave a pure culture of a gram-negative capsulated rod. No systemic symptoms were ever observed and nasal discharge ceased a day later. No other calves in this group have since shown any symptoms.

Group II. Three calves a few days old which had been housed in pens adjacent to the first group but not fed milk from heifer 9A showed the following symptoms: weakness and prostration, slight scouring, laboured breathing, and nasal discharge. One died at 14 days old, one at three weeks, and one at 10 weeks old. A gram-negative capsulated rod was recovered from all three by taking nasal swabs.

Group III. The calf of cow 46A was moribund when three days old and was slaughtered.

Post-mortem Findings

Post-mortem examinations were carried out on three of the dead calves.

(a) Calf dying at three weeks old. Extensive pneumonia: pus in left stifle joint. Klebsiella organism recovered from the lungs, but pus from joint was sterile.

(b) Calf dying at 10 weeks old. Extensive pneumonia, adhesions of lung with the pericardium and pericarditis. Klebsiella organism was recovered from lung.

(c) Calf of cow 46A. There was evidence of a septicaemia with patchy pneumonia. Blood gave a pure culture of Klebsiella organism.

After the first two cases of mastitis had occurred it was decided to culture a four-quarter milk sample from each of the lactating dairy animals, but no gram-negative capsulated rods were isolated.

Treatment

Heifer 9A was treated with neomycin sulphate ointment 3.5 mg. neomycin base per g. (Upjohn). 500 mg. of neomycin base was given by the intramammary route every day for three days as recommended by Hinze (1956), who found this the most effective treatment in his series of cases. At the time of the second dose the quarter was still hard, but down to normal size, and the inflammation had gone. The day after the third dose the hardness had disappeared and the quarter was normal, to all intents and purposes, but by this time the animal was practically dry. Four days later a small quantity of normal-looking milk could be expressed from the infected quarter; on blood agar this gave a few colonies of a gram-negative capsulated rod. Another specimen cultured the next day was sterile. Cultures made eight and 12 days after treatment were also sterile.

Buntain & Field (1953) stated that it might have been possible to eradicate the infection if a sufficient quantity of chlortetracycline had been available. Cow 5B was therefore given an intramuscular injection of chlortetracycline* at the rate of 2 mg. per lb. bodyweight, a total of 2.5 gm. This was repeated 24 hours later. Two tubes of chlortetracycline ointment (Lederle) was introduced into the infected quarter, this was repeated after 48 hours. By this time the animal was nearly dry. Three days later the secretion from the infected quarter was sterile. Samples taken from the quarter two weeks and three weeks later were also sterile.

Cow 46A was treated with chloramphenicol, in view of the drug sensitivity tests. One tube of chloramphenicol-dapsone† was introduced into the udder every 12 hours, a total of five tubes. Cultures up to 14 days after treatment were sterile. The milk yield dropped from 4 gallons to 1 gallon a day, and two weeks after treatment the animal was dry.

The calves in group II were treated with 400 mg. by mouth of chlortetracycline‡ and 150 mg.§ intramuscularly.

Organisms

I. *Organisms Recovered from 9A, 5B, and Calves, Groups I and II*

Morphology. Gram-negative, non-motile, capsulated, varying from almost cocci to rods up to 8 μ

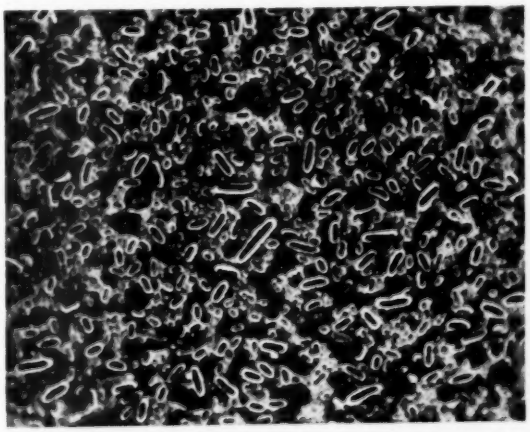

FIG. 1.—Indian ink preparation from an overnight culture of the organism isolated from heifer 9A. Magnification 1,070.

* Aureomycin (Achromycin Lederle).
† Dapsetyn (Allen & Hanbury's).
‡ Soluble tinted Lederle.
§ Achromycin (Lederle).

long, but averaging 1 μ × 2 μ → 4 μ with rounded ends.

Cultural Characteristics. Rapid growth occurred in broth producing a dense turbidity in three to four hours. In a glucose agar shake culture the medium was disrupted by gas. On blood agar, the colonies were large mucoid with a denser centre, greyish in colour, and non-haemolytic, but browning of the medium occurred. Good and rapid growth occurred on MacConkey agar, but no growth on desoxycholate-citrate-agar.

Biochemical Reactions. Indole +, M.R. +, VP +, Citrate −, and nitrates reduced. Growth in litmus milk gave acid in 24 hours and acid and clot in 72 hours. Gelatin not liquefied after 14 days. After 24 hours incubation with sorbitol, glycerol, arabinose, acid was produced, and with mannitol, dulcitol, lactose, glucose, trehalose, maltose, rhamnose, raffinose, and xylose, both acid and gas. Growth in sucrose produced acid in 18 days, in starch and dextrin acid in 12 days, and in salicin acid in 21 days. Aesculin, inositol, inulin, and adonitol were not fermented.

Pathogenicity. The organism was non-pathogenic for the mouse when 0.25 ml. of overnight broth culture was injected subcutaneously, or intraperitoneally.

Antibiotic Sensitivity. (a) Using Evans Sentests tablets on blood agar plates, the organisms showed the following reactions:—

Insensitive erythromycin and penicillin.

Chloramphenicol 1 cm. inhibition round 40 μg. tablet.

Streptomycin 3 mm. inhibition round 20 μg. tablet.

Chlortetracycline 1 cm. inhibition round 10 μg. tablet.

(b) Tube test. Chlortetracycline; failed to grow in concentration of 0.003 mg. per ml. in broth.

The organism was sent to Statens Serum Institut, Copenhagen, but unfortunately, work on Klebsiella had stopped so that serological typing was not possible.

For experimental reproduction of mastitis by this group of organisms see Easterbrooks and Plastridge (1956).

II. *Organism Recovered from 344*

Morphologically identical to I, but was a non-lactose fermenter; 0.25 ml. of an overnight broth culture killed mice within 12 hours after intraperitoneal injection.

Antibiotic Sensitivity. Using Evan's Sentests tablets on blood agar plates, this organism was found insensitive to penicillin, erythromycin, and chlortetracycline. There was a 5 mm. zone of inhibition around chloramphenicol and streptomycin tablets.

III. *Cow 46A and her Calf had Two Strains of this Organism*

One was a lactose fermenter and the other a non-lactose fermenter. The mixed strains showed sensitivity to chloramphenicol only, a 1 cm. zone of inhibition round a 40 μg. tablet.

Discussion

The purpose of this communication is to draw attention to an organism which only in the last few years has appeared as a cause of mastitis in the cow in three different countries. The extensive spread in two herds, one in this country (Buntain & Field, 1953) and the other in the U.S.A. (Hinze, 1956), the loss of flesh, the fact that an animal may cease lactation completely, and the threat to the lives of calves, all render this organism a serious threat to the dairy industry if it should become widespread. Treatment involves certain difficulties, probably due to a multiplicity of strains. The report of Buntain & Field (1053) indicated that penicillin and streptomycin by intramammary injection and sulphanilamide *per os* had no effect on the course of the disease, and that chlortetracycline eliminated infection in only 50 per cent. of cases. Hinze (1956) stated that 500 mg. of neomycin base in ointment per quarter daily for three days was the most successful. Sacchi (1956) stated that a mixture of oxytetracycline* and Polymixin B sulphate in ointment by the intramammary route showed a higher percentage of recoveries than neomycin. Hinze (1956) goes on to state that neither of these drugs has proved 100 per cent. effective, and drugs other than these are of little or no value.

Summary

Organisms of the Klebsiella group were responsible for four cases of mastitis which occurred in dairy cattle. The infection spread to calves by a route other than feeding infected milk. Treatment of the calves with chlortetracycline failed, but clinical and bacteriological cure was achieved in three of the cases of mastitis—one with neomycin, one with chlortetracycline, and the other with chloramphenicol. Due to the multiplicity of strains involved and to their varying drug sensitivity, the choice of drug for treatment must depend on sensitivity tests. New-born calves appear to be highly susceptible to infection, but older animals seem to be more resistant.

Acknowledgments.—I am grateful to Dr. J. H. Taylor, Cynamid of Great Britain Ltd., for a gift of Aureomycin and suggestions regarding dosage.

I am indebted to Mr. J. Gunn, Acting Head of the Duthrie Experimental Stock Farm, and to Mr. J. Crichton, Head of the Applied Nutrition Department, and his staff—to whose experimental groups some of the animals belonged—for their co-operation; also to Mr. E. Rattray for technical assistance; to Mr. J. Bruce for photomicrograph; to Mr. S. O. Mann for some of the biochemical tests, and to Dr. J. J. Bullen, Head of the Pathology Department, for his interest and encouragement.

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* Terramycin.

In Brief

PANCREATITIS IN THE DOG

A valuable contribution to our knowledge of the pancreatic duct system was made by Nielson & Bishop (1954) who demonstrated five types. In 68 per cent. of glands the two main ducts, one from each limb of the "boomerang," met and continued to the minor duodenal papilla, thus forming a Y, and from one of the main ducts a smaller duct (duct of Wirsung) opened into the duodenum at or very near to the major duodenal papilla where the bile duct opens into the duodenum. A third group, bringing the total to 84 per cent., also had two separate openings to the duodenum and interductal anastomosis.

Stein *et al.* in a series of experiments in the dog demonstrated that ligation of the pancreatic duct did not cause acute haemorrhagic pancreatitis but simply an interstitial pancreatitis. If pancreatico-choledochostomy was followed by obstruction of the major duodenal papillae (sphincter of Oddi) acute haemorrhagic pancreatitis quickly ensued which was fatal in the majority of cases. If the animal survived more than a week healing proceeded, resulting in a chronic pancreatitis.

It is interesting to relate this experimental evidence with the recent work of Thordal-Christenson and Coffin (1956) which gives an excellent description of the clinical forms of pancreatitis.

Their series of 43 cases was taken from 1,500 autopsies and were composed of (*a*) 14 cases of acute necrotic (haemorrhagic) pancreatitis characterised by an acute abdominal disease with pain on abdominal palpation. The disease was often fatal after a few days and protracted diabetic symptoms sometimes developed.

Contrary to the experimental evidence referred to above, reflux of bile did not seem to be a cause although they agree that obstruction of the pancreatic duct does not in itself cause acute pancreatitis. The affected animals were usually obese.

These writers consider that the disease is of a metabolic nature or due to some aetiological factor in the gland itself. Clearly this is an interesting problem awaiting solution, some support to the opinion that factors causing influx of bile into the pancreas may cause the condition was given recently by Singleton and Rhodes (1957).

In subacute or chronic pancreatitis (19 cases), deficiencies of both exocrine and endocrine secretion occur, *i.e.* meteorisms, steatorrhoea due to acinus damage and diabetes mellitus caused by damage to the islands of Langerhans. Histopathological evidence points to this condition following acute cases and in fact there are records in which relapsing pancreatitis has ended in the chronic condition.

In pancreatic fibrosis (five cases) there is clinical evidence of diminished exocrine secretion but this group did not show evidence of diabetes. Histologically there were no changes to suggest that the acute disease had preceded the fibrosis.

Collapse or atrophy of the acinus tissue (five cases). Again no dog in this group showed evidence of diabetes, but all were dejected and emaciated in spite of a ravenous appetite. The stools were loose, foamy and oily. The writer has noted in such cases that the faeces often smells of rancid butter and the quantity passed always abnormally great. The duration of illness is one to several months. Although the authors did not encounter diabetic cases in this group, no islands of Langerhans could be seen histologically. The tissue was composed of fasciculi of indifferentiated cells with no fibrosis.

Although pathologically the differentiation between pancreatitis fibrosis and atrophy is distinct, from the writer's point of view, the clinical differentiation is extremely difficult.

W. B RIAN SINGLETON (Feb., 1957)

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Current Literature

ABSTRACTS

Strain Differences in the Incidence of Cage Layer Fatigue.* FRANCIS, D. W. (1957). *Poult. Sci.* **36.** 181–3.

The author found a significant difference in the incidence of battery cramp in seven strains of pullets kept under apparently identical conditions on the same farm. Affected birds tended to recover if identified at an early stage and removed from the battery cage, but the recovery rate varied from one strain to another.

E.A.G.

Equine Euthanasia. ROBERTS, N. C. (1956). *J.A.V.M.A.* **129.** 328.

The destruction of horses frequently has to be performed in front of the public. The author has, therefore, sought a method which involves no danger to the onlookers and which produces rapid death with the minimum of struggling, and little risk of failure at the first attempt. For this purpose he recommends the rapid injection of 100 ml. of a solution containing sodium N-amylethylbarbiturate and sodium sec.-butylethylbarbiturate into the jugular vein. The solution is injected through a 14-gauge needle and should be completed within 30 seconds. In cold weather it should first be warmed in hot water in order to render it less viscid.

In the 23 cases described the horses all collapsed within one minute of the injection. They were anaesthetised before falling and therefore showed no evidence of pain. In only two of the cases was there any struggling after the collapse. In neither of these was there a return of consciousness, but in one case it was necessary to inject a further 50 ml. of solution before death ensued. In the remaining 21 cases death occurred within a few minutes of the injection.

U. P.

* Battery Cramp.

In Parliament

Export of Live Cattle

MR. SNOW (May 22nd) asked the Minister of Agriculture, Fisheries and Food whether he is aware that the reductions in exports of cattle on the hoof is not due to Government action but to rises in domestic prices; and whether he will introduce legislation or issue regulations to prevent the present cruelty to animals by restricting exports to those Continental importers who are approved by his Department as observing satisfactory practices in animal welfare.

MR. GODBER: My right hon. Friend regrets that he is unable at present to add to the statement made in the House on May 8th.

Inter-Government Discussions

MR. HURD (May 23rd) asked the Minister of Agriculture, Fisheries and Food if he will now make a further statement on the measures being taken to prevent maltreatment of cattle exported to the Continent.

MR. GODBER: We have to-day learned that the Governments concerned have agreed to joint discussions with us starting very shortly. Discussions are proceeding with British interests about the recommendations of the Balfour Committee which concern our domestic arrangements.

Slaughter-houses

MR. F. WILLEY (May 23rd) asked the Minister of Agriculture, Fisheries and Food which were the slaughter-houses referred to in the report of the committee of inquiry into the export of live cattle which failed to satisfy the standards required by the United States Army Veterinary Corps; and in what respects did they fail.

MR. GODBER: My right hon. Friend is communicating with Lord Balfour of Burleigh, who was the Chairman of the Committee, and will write to the hon. Member as soon as possible. He understands, however, that the requirements of the U.S. military authorities for slaughter-house equipment include steam hoses and cool air chambers, which are not normally available in this country.

MR. WILLEY: Does not the hon. Gentleman admit that it is an awful reflection upon conditions in this country if we have to export cattle to be slaughtered for the United States Army? It is disgraceful reflection upon the state of our slaughter-houses. Will the hon. Gentleman give an assurance that we shall have legislation next Session to deal with this disgrace?

MR. GODBER: The hon. Gentleman will be aware that we are considering new legislation dealing with slaughter-houses, and I hope that it will come before the House next Session. In the meantime, we are producing draft regulations as a guide to people who are proposing to improve their slaughter-houses, and I hope these will be available very shortly.

Veterinary Surgeons

MR. HURD (May 23rd) asked the Minister of Agriculture, Fisheries and Food how many veterinary students graduate each year; to what extent the number of qualified veterinary surgeons is increasing: and if he is satisfied that the present veterinary schools are adequate to meet the calls on the profession.

MR. GODBER: On average over the last five years about 230 new veterinary graduates have been added annually to the statutory register, while the total number on the register has increased by about 130 a year. My right hon. Friend has no reason to think that the existing veterinary schools are unable to provide a reasonable flow of graduates.

Poultry

MR. WILLEY (May 27th) asked the Minister of Agriculture, Fisheries and Food, as representing the Lord President of the Council, what amount he estimates will have been devoted to poultry research during the financial year 1956-7.

MR. GODBER: It is estimated that approximately £145,000 from public funds will have been devoted to poultry research during 1956-7.

News and Comment

NEW PRESIDENT FOR THE INTERNATIONAL VETERINARY CONGRESS

At a meeting of the Permanent Committee of the International Veterinary Congress in Paris on Thursday, May 23rd, the resignation of Sir Daniel Cabot from the Presidency was announced. Professor W. I. B. Beveridge, who represents Australia, was elected in his place, and it is understood that he will continue to act as President until the next Congress is held.

It was also reported that an invitation had been received from Chile to hold the Congress in South America, and this invitation was accepted for 1958.

THE FITZWYGRAM, WILLIAMS, WALLEY AND LAWSON PRIZES

The Prize Board for the above prizes hereby gives notice that the subject selected for the essay competition open to candidates who obtain a registrable qualification in the calendar year 1957 is:—

> "It is suggested that there is an increase in the incidence of metabolic diseases of cattle under modern farming conditions. Discuss this hypothesis with special reference to the Milk Fever syndrome, Hypomagnesaemia, and Ketonaemia."

Intending candidates are referred to the regulations for the prizes on pages 495 and 496 of the Register of Veterinary Surgeons (1956), and may obtain further information from the Registrar, R.C.V.S., 9-10, Red Lion Square, London, W.C.1.

THE STEELE-BODGER MEMORIAL PRIZE

This Prize was created by the fund established in 1953 to perpetuate the memory of the late Harry Steele-Bodger. It takes the form of a travelling scholarship, or a contribution to a tour abroad. In

addition applications for grants of small amounts to enable practising members of the profession to make short study tours abroad would receive sympathetic consideration.

Members of the Royal College of Veterinary Surgeons are eligible; together with final-year students of any of the university veterinary schools in the United Kingdom and Eire.

The closing date for applications is July 31st, and further particulars may be obtained from the General Secretary of the B.V.A.

THE QUEEN'S CHAPEL OF THE SAVOY

R.C.V.S. Day on June 5th will commence with a corporate Service in the Queen's Chapel of the Savoy, and the following historical notes may be of interest both to those members who will be able to attend the ceremony and to those who will be unable to be present.

The Chapel of the Savoy is the Private Chapel of Her Majesty the Queen in right of her Duchy of Lancaster and it is thus a "free Chapel" of which she is both spiritual and temporal overlord. The Chapel was originally part of the ancient Palace which was erected in the Manor granted to Peter of Savoy in 1246. It was John of Gaunt's son, Henry IV (Bolingbroke), Duke of Lancaster, who made a declaration in 1399 to the effect that all the estates of the House of Lancaster, including the Manor of the Savoy, should be annexed to the Crown and yet at the same time remain a separate inheritance.

The names of Geoffrey Chaucer, John Wycliffe, Samuel Pepys, and Thomas Fuller have all been closely linked with the history of the Chapel. During the Commonwealth, the Independents drew up their "Confession of Faith" at the Savoy in 1658, and the important Conference on the Book of Common Prayer took place in 1661 at the famous "Savoy Conference."

On the occasion of his Coronation in 1937, the late King George VI placed the Chapel at the disposal of the Royal Victorian Order and the Chapel is therefore the Chapel of the Order and Her Majesty the Queen is Sovereign of the Order. Her Majesty the Queen Mother is the Grand Master.

The Services are normally open to the public with the exception of those on special and official occasions such as that on June 5th.

PROHIBITION OF IMPORTATION OF ANIMALS FROM THE CHANNEL ISLANDS

Because of an outbreak of foot-and-mouth disease in Jersey, an Order has been made by the Minister of Agriculture, Fisheries and Food and the Secretary of State for Scotland prohibiting the importation of cattle, sheep, goats or any other ruminating animals, or swine, carcases, animal products, hay and straw into Great Britain from the Channel Islands.

Copies of the Order, which came into operation on May 25th, 1957, may be obtained from the Ministry of Agriculture, Fisheries and Food, Animal Health Division, Hook Rise, Tolworth, Surbiton, Surrey, or from the Department of Agriculture for Scotland, St. Andrew's House, Edinburgh, 1.

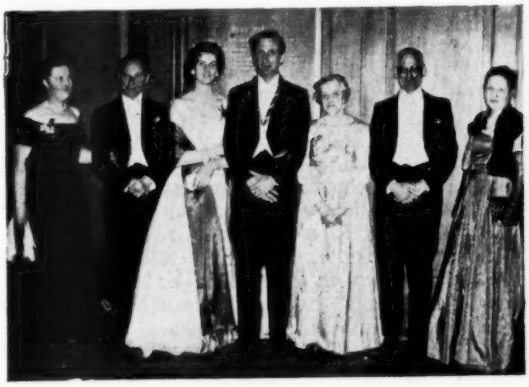
UNIVERSITY NEWS

Cambridge

Professor W. I. B. Beveridge attended the first meeting of the Technical Co-ordinating Committee on Agriculture and Allied Research in the West Indies, on behalf of the Colonial Office. He visited Jamaica, Trinidad, British Guiana and Barbados to see the work on live-stock and animal diseases in those territories.

R.V.C. STUDENTS' UNION SOCIETY ANNUAL BALL

The 165th Annual Ball of the Royal Veterinary College Students' Union Society was held at the College on Friday, May 24th. It was the first time that the Ball had been held at the Royal Veterinary College and there was a record attendance of over 300 students and guests.



Left to right.—Mr. and Mrs. Pugh, Mr. Hughes' lady, Mr. Hughes (President of the Students' Union), Mrs. Glover, Dr. Glover (Principal and Dean of the Royal Veterinary College and Patron of the Students' Union Society), and Mrs. Hodgman.

The revellers were well provided with facilities for refreshment: four bars were available for those who wished to fortify themselves before the dancing commenced, and from 10 p.m. until 2 a.m. there was a sumptuous American buffet. The Officers of the Union entertained their guests to this splendid repast shortly before midnight, and music was provided throughout by Chappie D'Amato's Dance Orchestra.

The guests included Dr. R. E. Glover, Principal and Dean of the Royal Veterinary College, the Patron of the Society, and other members of the veterinary and allied professions. Representatives of other societies in the University of London were also present.

The reception was scheduled for 9 p.m., and after a splendid variety of dances the Ball was finally brought to a close at 4 a.m. with an energetic "Post Horn Gallop."

Mr. R. J. THOMAS, M.R.C.V.S., D.V.S.M.

R. D. and A. G. B. write:—

It is with deep regret that we record the passing on May 16th, 1957, of Robert John Thomas, at the early age of 45. After qualifying at the Royal Veterinary College, London, in 1934, Robert Thomas obtained the D.V.S.M. at Manchester in the following year, and was soon appointed to the veterinary staff of the Liverpool Corporation. In 1938 he was transferred to the Animal Health Division and was stationed at Aberystwyth; there he remained until 1952 when he was promoted to Divisional Veterinary Officer and transferred to Haverfordwest in charge of Pembrokeshire.

"Bob" to all his friends, he was of a cheerful disposition and a person of high integrity. Those of us who had the privilege of working with him learned to value and admire his qualities. He gave of his best and performed his duties with dignity. He took pride in his profession and was an active member of the South Wales Division. Until recently he held the office of Treasurer, but, owing to failing health, he had to relinquish it, although it was hoped at that time that his health would be restored. Throughout his illness he had remained cheerful, and the end came rather suddenly and unexpectedly.

He had been the Welsh Representative of the Association of State Veterinary Officers, and he was also a keen Rotarian and a popular speaker at their functions. Photography was his greatest hobby, and he was an enthusiastic member of the local camera club.

The funeral service was held at the Wesley Church, Haverfordwest, and his body laid to rest at the Haverfordwest Cemetery on May 21st. The large gathering included many representatives of the agricultural community and people from other walks of life, and was ample evidence of Mr. Thomas's popularity in the county. The profession was also well represented and 27 members were present to pay their last respects to a true colleague.

Our deepest sympathy goes out to his widow and to his two young daughters.

R.C.V.S. OBITUARY

We announce with regret the death of the following member of the profession:—

PROCTOR, Albert Edward, 6, Chatham Street, Manchester, 11. Graduated Liverpool, July 14th, 1922. Died Sunday, May 26th, aged 59 years.

PERSONAL

Birth

CAMPBELL.—On May 25th, 1957, to Betty, wife of Donald Campbell, M.R.C.V.S., of Lydstep, Oakworth, Keighley, a son.

DICKSON.—On May 18th, 1957, to Nancy, wife of Ian Dickson, M.R.C.V.S., of 47, Punton Road, Stanwix, Carlisle, a son, Ian Craig, brother for Ann.

POTTER.—On May 10th, 1957, to Joy, wife of Robert Potter, M.R.C.V.S., of 34, London Road, Stevenage, Herts, a brother for Robin and Pamela.

COMING EVENTS

June

5th (Wed.). Royal Veterinary College Association annual dinner at R.V.C., 6.30 for 7 p.m.

Meeting of the Scottish Metropolitan Division, B.V.A., to visit Ethican Suture Laboratories, 126, Fountainbridge, Edinburgh, 2.30 p.m. Business meeting 5 p.m.

6th (Thurs.). Annual General Meeting of the Ayrshire Veterinary Association in the Station Hotel, Ayr, 2.30 p.m.

12th (Wed.). Annual General Meeting of the Midland Counties Veterinary Association at the Birmingham Medical Institute, 36, Harborne Road, Birmingham, 15, 2.30 p.m.

Annual Meeting of the R.A.V.C. Golfing Society at the North Hants Golf Club, Fleet, 10 a.m.

Meeting of the Scottish Branch, B.V.A., at the Royal (Dick) School of Veterinary Studies, 2.30 p.m.

13th (Thurs.). Annual Dinner of the R.A.V.C. Officers' Club at the Grosvenor House, Park Lane, London, W.1.

14th (Fri.). Annual Dinner of the Chiron Club at the Royal Hotel, Bristol, 7 p.m.

21st (Fri.). Ordinary General Meeting of the South Wales Division in the Cambrian Hotel, Saundersfoot, 2.30 p.m.

August

25th-31st. 75th Annual General Meeting and Congress of the B.V.A. at Cambridge.

FOOT-AND-MOUTH DISEASE

The area described in the schedule below is declared to be an Infected Area for the purpose of preventing the spread of foot-and-mouth disease. An area comprising:—

The County Borough of Ipswich.

IN THE COUNTY OF EAST SUFFOLK

In the Petty Sessional Division of Woodbridge: The parishes of Felixstowe. Trimley St. Mary, Trimley St. Martin, Falkenham, Kirton and Bucklesham.

In the Petty Sessional Division of Orwell: The parishes of Rushmere St. Andrew, Foxhall, Purdis Farm, Nacton, Levington, Brightwell, Stratton Hall, Sproughton, Burstall, Hintlesham, Washbrook, Chattisham, Raydon, Wenham Parva, Wenham Magna, Shelley, Holton St. Mary, Higham, Capel St. Mary, Copdock, Belstead, Wherstead, Bentley, East Bergholt, Stratford St. Mary, Brantham, Tattingstone, Freston, Woolverstone, Chelmondiston, Shotley, Arwarton, Harkstead, Holbrook and Stutton.

IN THE COUNTY OF ESSEX

The Boroughs of Colchester and Harwich.

The Petty Sessional Divisions of Harwich and Tendring.

In the Petty Sessional Division of Lexden and Winstree: The parishes of Langham, Dedham, Wivenhoe, Elmstead, Alresford and Brightlingsea.

The area described in the Schedule below shall cease to be an Infected Area for the purpose of preventing the spread of foot-and-mouth disease on June 6th, 1957:—

IN THE COUNTY OF KENT

In the Petty Sessional Division of Dartford: The parishes of Swanley, Sutton-at-Hone, Longfield, Farningham, Hor-

ton Kirby, Fawkham, Hartley, Eynsford, West Kingsdown and Ash-cum-Ridley and so much of the parishes of Darenth, Stone and Southfleet as lies to the south of the main road (A2) running from Dartford to Rochester, excluding the said road.

In the Petty Sessional Division of Sevenoaks: The parishes of Shoreham, Otford and Kemsing, and so much of the parishes of Sevenoaks and Seal as lie to the north of the main road (A25) running from Sundridge via Riverhead to Borough Green, including the said road.

In the Petty Sessional Division of Malling: The parishes of Stansted, Wrotham and Borough Green and so much of the parish of Ightham as lies to the north of the main road (A25) running from Riverhead to Borough Green, including the said road.

In the Petty Sessional Division of North Aylesford: So much of the parish of Meopham as lies to the west of the main road (A227) running from Gravesend to Wrotham, including the said road.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Cumberland. Beech House, Cumwhinton, Carlisle (May 20).

Durham. Gainford Hall Farm, Gainford (May 20).

Leics. Grange Farm, Oadby (May 21).

Norfolk. Saunders Farm, Fundenhall, Norwich (May 24).

Sussex. Whitelands Farm, Ashington, Pulborough (May 24); Huddlestone Farm, Steyning (May 25).

Westmorland. New Hall, Staveley, Kendal (May 24).

Yorks. 11, The Crescent, Micklefield, Leeds (May 20); Dove Hill Allotments, Park View, Royston, Barnsley (May 23).

Fowl Pest

Cambs. Miller Court Priory, Downham Road, Outwell, Wisbech (May 20).

Lancs. Moorhouse Farm, Land Lane, Longton; New Moss Hall Farm, Little Hoole; Winston Farm, Drumacre Lane, Longton (May 20); Mayfield, Hall Lane, Longton; 265, Hesketh Lane, Tarleton; 267, Hesketh Lane, Tarleton (May 22); Astley Bank, Carr Lane, Tarleton (May 23); Belvedere Nurseries, Hesketh Bank; 269 Hesketh Lane, Tarleton (May 24); Tarleton Lane, Tarleton (May 26).

Yorks. The Cottage, Rawdon Hill, Arthington, Leeds (May 21).

Swine Fever

Berks. Clover Dene, Poplar Lane, Winnersh, Wokingham (May 21).

Devon. Slade Farm, Payhembury, Honiton (May 21).

Dorset. Stones Farm, Hillfield, Cerne Abbas, Dorchester (May 22).

Hants. Rose Cottage, Hill House, Hill, Liphook (May 24).

Kent. The Grove Farm, Fawkham, Dartford (May 22).

Lancs. Ealees Piggeries, Littleborough (May 21).

Middx. Sipson Farm, Sipson, West Drayton (May 23).

Norfolk. Piggeries, Opposite Sibton House, The Street, Newton St. Faith, Norwich (May 21).

Oxford. Piggeries, rear of 12, St. Andrews Lane, Headington (May 23).

Somerset. The Farm, Mudgley, Wedmore (May 21); Wraxall Court, Wraxall (May 24).

Surrey. The Piggeries, Westley Green Farm, Valley End, Cobham (May 20); Birchen Hey, Frensham, Farnham; New Close Farm, Dorking (May 22); Hullers, Beare Green, Dorking (May 23); Heathyfields Farm, Old Park Lane, Farnham (May 24).

Sussex. Borers Yard, Copthorne, Crawley (May 23).

Yorks. Southcliff Farm, Hornsea (May 21); Sycamore Farm, Shelley Woodhouse, Huddersfield (May 23); Hollroyds Yard, Nab Lane, Slaithwaite, Huddersfield (May 24).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

Bovine Ringworm

Sir,—I found Mr. John Forster's article on bovine ringworm in last week's RECORD of considerable interest. We have recently had some experience with hexadecamethylene-1:16-bis (isoquinolinium chloride)*. It was used first on two calves each of which was infected in two areas the size of a five shilling piece. These cleared up with one dressing and, following this, about 25 calves, each of which had several patches of infection about 1½ inches in diameter, were treated. All these calves were cleared with one application, but it was noted that where the scales and crusts were not adequately removed with soda, *e.g.*, close around the eyes, the treatment was not so efficacious. From this outbreak of infection Austwick, at Weybridge, isolated *Trichophyton verrucosum*.

It is rather a peculiar feature of the older treatments for ringworm such as sulphur in oil, iodine preparations, mercury or salicylic acid compounds that, although on a number of farms the cattle ringworm lesions all have a typical clinical appearance of *Trichophyton discoides*, one of these medicaments will appear very effective on one farm, but not on another. It will be interesting to see if the same applies to hexadecamethylene-1:16-bis (isoquinoliniumchloride).

Further to a recent paper on a new prolapse retainer for the ewe, I would like to add that although the advantage of being able to lamb "past" the retainer is not proven to us, nevertheless the shepherd can easily see when a ewe fitted with a retainer is about to lamb for the foetal membrane readily comes past the retainer. Incidentally, since writing the paper, some bad prolapses have been retained by tying the wool laterally across the vulva after the retainer has been placed in position and by securing the wool tightly to the vulval lips.

Yours faithfully,

The Ord, N. G. FOWLER.
34, New Dover Road,
Canterbury,

May 21st, 1957.

* Tinevet.

The Use of Glycyrrhetinic Acid

Sir,—An article and two letters have recently appeared in your columns on the use of glycyrrhetinic acid preparations in small-animal practice. We also were invited, by the same company, to carry out trials on these preparations which had already been found useful in medical practice.

In the early stages we carefully selected a few cases to see whether trials would be worth while. Some of these produced such impressive results that we decided to continue with large numbers again selecting cases in which we knew we would have good owner-co-operation and in which we knew what normally would be the result. We were quite amazed at the results in some cases which were relieved very quickly; the preparations cured more

rapidly than those used in previous lines of treatment. In particular, the preparation found most useful was the ophthalmic ointment containing glycyrrhetinic acid and neomycin.

The animals treated were mainly dogs but we also had a few cats. The cases included acute and chronic otitis, keratitis, ulceration of the eyelids and commisures, "acute wet eczema" of ears, eyes, and scrotum and infected anal glands. In many cases treatment had been carried out for a considerable time with other preparations with poor results. We found that even in these cases there was usually a rapid improvement; often after only one or two applications an animal which had previously resented interference allowed the preparation to be applied without any form of restraint.

We would like to note in particular the excellent results obtained by using this product in the treatment of infected anal glands. We used the intramammary pack, the nozzle of which can easily be inserted into the orifice of the gland.

In the case of corneal ulcers, we consider that a certain amount of inflammation is necessary for repair and we suggest that, physiologically, glycyrrhetinic acid preparations are contra-indicated in this condition as they reduce inflammation.

Finally, we would like to note that in the few comparisons we have been able to make glycyrrhetinic acid gave better results than hydro-cortisone preparations, and in view of its lower cost and excellent results we feel that glycyrrhetinic acid has a useful place in small-animal practice.

Yours faithfully,

J. J. DAVIES,
A. FAIRWEATHER.

1, Church Street,
West Ham, E.15.
May 21st, 1957.

Sir,—I was most interested to read of the results obtained with glycyrrhetinic acid by O. F. and E. K. M. Jackson, as published in your issue of April 27th, 1957, which has just arrived here.

Whether there is indeed any great virtue in the combination of neomycin with glycyrrhetinic acid I do not know. My results were obtained with aqueous solutions of the salt as obtained from the manufacturers. Very dilute solutions, of the order of 0.2 per cent., produced results as good as those from the use of solutions 20 times as strong. I chose the watery solution rather than an ointment because I considered that the salt would thus come in more intimate contact with the affected tissues.

That troublesome condition, miliary eczema in the cat, responded very favourably to glycyrrhetinic acid treatment in my experience. I wonder whether the Jacksons or other workers have found it as successful?

Yours faithfully,

BRENDAN HALPIN.

The Veterinary Department,
Potiskum,
Northern Region,
Federation of Nigeria.

Reference

HALPIN, B. (1956). *Brit. Vet. J.* **112**, 496-9.

Sarcoma in Cattle

Sir,—Mr. J. T. Morton's clinical note in THE VETERINARY RECORD of May 11th, 1957, on sarcoma in cattle interested me very much. In 1955 I had two yearling Ayrshire heifers that developed this large swelling on the neck from the jaw to the brisket. Pathological examination proved this to be a "lymphosarcoma." My client was most perturbed as this swelling started a few weeks after tuberculin testing, and he blamed that for it; also, as they had been in the same field, he blamed some old hedge for starting it off.

The coincidence of these two cases so close together was most disconcerting.

Yours faithfully,

G. M. G. OLIVER.

Ashfield,
Lanchester,
Durham.
May 21st, 1957.

Magnesium Sulphate

Sir,—In *The British Veterinary Codex* the dose of magnesium sulphate given for equines is 1 to 4 ounces and we are told that this drug is an unsuitable purgative for horses. I should not have known of these remarks had not the manager of a firm of retail druggists queried the label "Not recommended for Horses" on their 7 lb. package of Epsom Salts supplied for cattle.

For over 20 years it has been my practice to administer salines by stomach tube (after due preparation of the horse) the dose varying from 4 to 6 ounces of common salt with 6 to 12 ounces of magnesium sulphate in 1 to 1½ gallons of tepid water. The effect of this on racing stock, ranging in age from yearlings upwards, is to produce a mild purgation and diuresis lasting from 3 to 12 hours. Super-purgation has never been encountered and I have always regarded this method as being the best possible way of giving a mild purgative to horses on a high nitrogenous diet without interfering with their training progress. Forty-eight hours after medication the animals appear to be feeling extra well and fresh.

The British Veterinary Codex is a modern publication and a very useful one, but with all deference I maintain that the information given concerning this commonplace drug is misleading. Magnesium sulphate, given in the manner described, is in fact a reliable and harmless purgative for the horse, provided the animal is properly prepared.

Yours faithfully,

A. E. CAREY FOSTER.

Quarry Farm,
Newchapel,
Lingfield,
Surrey.

May 24th, 1957.